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Adhami, R., Operational Vibration Specification of Helicopter Stores Using Wavelet Analysis, V. 41, No. 5, p. 17. (Abstract—see Hale, M.T.)

Alvarez, D., Exposure of Inert Gas Purifiers to Air Studies on Hydrocarbon Release in Resin-Based vs. Nickel-Based Purifiers, V. 41, No. 6, p. 26. *Gas purification is an integral part of many semiconductor manufacturing processes. Accidental air contamination into gas delivery systems can lead to adverse consequences. This paper addresses the use of inorganic nickel-based purifiers versus organometallic resin-based purifiers in the event of air intrusion. Tests were performed under conditions that simulate a large purging error. Both purifier technologies undergo reaction exotherms. Hydrocarbon oil release, which results in catastrophic system contamination, occurs with organometallic resin purifiers. For nickel-based purifiers, system contamination is limited to air breakthrough.* (CC: Cleanroom Design/Materials, Cleanroom Operations/Procedures, Sources and Effects)

B

Barker, D.B., Tailoring Temperature/Humidity Life Tests with In-Service Environment Data, V. 41, No. 4, p. 36. (Abstract—see Cluff, K.D.)

Bergen, T.F., Development of Acoustic Test Criteria for the Cassini Spacecraft, V. 41, No. 1, p. 26, 1998. *Acoustic measurements from eight Titan IV flights, and an acoustic test of a Cassini simulator and Titan payload fairing (PLF), were used to derive acoustic flight and test criteria for the Cassini spacecraft. The flight and laboratory data were used or modified to account for the following factors: (a) noise-spike contamination of flight data, (b) spatial and flight-to-flight variations of flight data, (c) application of a thicker barrier-blanket to the PLF for the Cassini mission, (d) effects of locating two Cassini assemblies, the Huygens Probe (HP), and the High Gain Antenna (HGA), near the PLF, and (e) higher thrust of upgraded Titan solid rocket motors (SRMs) for the Cassini mission.* (DTE: Acoustics, Criteria and Standards, Test Tailoring)

Bhattacharjee, H.R., Comprehensive Particle and Fiber Testing for Cleanroom Wipers, V. 41, No. 6, P. 19. *A microscopy-based measurement technique has been developed for accurately quantifying the total number of particles and fibers in all size ranges released from a cleanroom wiper during conditions of simulated use. The method uses both optical and scanning electron microscopy in conjunction with computerized image analysis for counting particles and fibers. The technique uses a single sample preparation for the extraction of both particles and fibers from the wiper. Seven cleanroom wiping products were examined using this measurement technique. The results are shown for the various size groupings of particles and fibers. A composite measure of contamination is presented. This work reveals that a cleanroom wiper may appear very clean in certain size categories and appear extremely dirty in others. The results of this study show that all size ranges of particles and fibers need to be examined when determining the total contamination risk posed by any cleanroom wiper.* (CC: Cleanroom Operation/Procedures; Identification, Measurement, and Monitoring)

Brause, E., In-Situ Chemical Concentration Control for Wafer Wet Cleaning, V. 41, No. 3, p. 24. (Abstract—see Kashkoush, I.)

C

Caruso, H., A Fundamental Overview of Accelerated Testing Analytical Models, V. 41, No. 1, p. 16, 1998). *This paper describes analytical models that are commonly used for product life estimation and accelerated life testing. Model descriptions include: Miner's "Rule" for describing accumulated fatigue damage; Coffin-Manson nonlinear power law, often applied to mechanical fatigue damage; Rudra model for CFF failures; Arrhenius steady-state temperature acceleration model for estimating chemical aging effects; Peck's model for accelerated combined temperature-humidity effects; and Kemeny model for combined temperature and voltage acceleration effects. The general form of these models will be presented along with specific guidance regarding: relative strengths and appropriate applications for each model; limitations and sources of uncertainty for each model; and example values for exponents and material coefficients.* (DTE: Climatics and Thermal, Shock and Vibration, Test Tailoring, Test Time Compression; PR: Durability/Fatigue, Reliability Achievement, Stress Screening)

Chen, M., The New Triaxial Shock and Vibration System at Hill Air Force Base, V. 41, No. 2, p. 27. *To achieve large-missile guidance qualification, modification, and reliability tests and analysis, the Hill Air Force Base Survivability*

& Vulnerability Integration Center (SVIC) has installed a six-degree-of-freedom shock and vibration system. Designed and developed by Wyle Laboratories Inc., this system is driven in the frequency range of 5 to 2000 Hz by eight electrodynamics shakers, two in each horizontal axis and four in the vertical axis. The major design concern is the coupling of the shakers through a rigid table due to kinetic and dynamic effects and the behavior of the structure. A method was developed that coordinates the drive signals to compensate for cross-coupling effects. This paper discusses design objectives, provides a brief description of the hardware, and elaborates on the high-speed, digital control system driving the eight electrodynamics shakers. A brief description of the test results is provided. (DTE: Shock and Vibration, Test Tailoring)

Ciotti, R.J., Empirical Validation of a Gas Distribution System Moisture Drydown Model, V. 41, No. 2, p. 33. (Abstract—see Dheandhanoo, D.)

Cluff, K.D., Tailoring Temperature/Humidity Life Tests with In-Service Environment Data, V. 41, No. 4, p. 36. *Humidity combined with temperature and voltage is considered a major failure stimulus in electronic components, printed wiring boards, and assemblies. Accelerated temperature/humidity tests are commonly used to evaluate the moisture resistance of electronics, but these are rarely linked to the application environment. This work proposes a methodology to determine realistic tests based on measured usage environments. Plastic encapsulated microcircuits in the commercial airplane environment will be used to demonstrate the approach.* (DTE: Climatics and Thermal, Test Tailoring, Test Time Compression; PR: Reliability Achievement)

Cobb, R.G., Use of a Zero-Gravity Suspension System for Testing a Vibration Isolation System, V. 41, No. 6, p. 43. (Abstract—see Idle, M.K.)

Cook, J., Exposure of Inert Gas Purifiers to Air Studies on Hydrocarbon Release in Resin-Based vs. Nickel-Based Purifiers, V. 41, No. 6., p. 26. (Abstract—see Alvarez, D.)

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Demmin, H.C., A Sampling System for Measurement of Nanometer-Sized Particles in Hydrogen, V. 41, No. 2, p. 23. (Abstract—see Malczewski, M.L.)

Dheandhanoo, S., Empirical Validation of a Gas Distribution System Moisture Drydown Model, V. 41, No. 2, p. 33. *Moisture is the most difficult impurity to remove from gas distribution systems due to its adsorption and desorption behavior. Several theoretical models have been proposed to understand moisture behavior and to predict the drydown time of gas distribution systems. We recently developed a model that takes into account the fluid dynamics of the bulk gas stream and incorporates two drydown regimes: a physisorbed regime and a chemisorbed regime. This paper compares experimental drydown data with model simulations of gas distribution systems under various configurations and conditions.* (CC: Cleanroom Design/ Materials, Modeling and Simulation)

G

Goodding, J.C., Use of a Zero-Gravity Suspension System for Testing a Vibration Isolation System, V. 41, No. 6, p. 43. (Abstract—see Idle, M.K.)

H

Haile, W.B., Validation of a Simple Formula for Force Limits in Vibration Testing, V. 41, No. 4, p. 24. *A new formula for the limiting force to be used in dual control vibration testing is explored by use of a simple but general-purpose example. The results of the force formula are compared with the exact solution and found to be in excellent agreement. Extrapolation from random vibration to sine sweep testing is included.* (DTE: Shock and Vibration)

Hale, M.T., Operational Vibration Specification of Helicopter Stores Using Wavelet Analysis, V. 41, No. 5, p. 24. *A discussion of classical signal analysis techniques for both stationary and nonstationary data and the corresponding shortcomings of each is available in Reference 24. The earlier work proposed wavelet-based signal analysis as a potential tool in the analysis and specification development of nonstationary vibration events. This paper is a continuation of this work with application toward the operational vibration specification development of nonstationary vibration events measured on helicopter stores. Wavelet analysis will be reviewed and followed by a tailored wavelet-based operational vibration specification proposal.* (DTE: Shock and Vibration, Test Tailoring)

Himelblau, H., Development of Acoustic Test Criteria for the Cassini Spacecraft, V. 41, No. 1, p. 26, 1998. (Abstract—see Bergen, T.F.)

Holmer, A.E., A Sampling System for Measurement of Nanometer-Sized Particles in Hydrogen, V. 41, No. 2, p. 23. (Abstract—see Malczewski, M.L.)

I

Idle, M.K., Use of a Zero-Gravity Suspension System for Testing a Vibration Isolation System, V. 41, No. 6, p. 43. The *Air Force Research Laboratory team has been confronted with many unique testing challenges in the BMDO-sponsored Vibration Isolation and Suppression System (VISS) performance test program. VISS incorporates a combination passive/active vibration mitigation technology in a Stewart platform configuration to provide a mechanically quiet platform for a medium-wavelength, infrared camera. VISS actuator stiffnesses, insufficient to support the payload in a 1-g field, require a gravity off-load system to simulate the free boundary conditions of space. A performance test series characterized the test fixture dynamics, VISS payload dynamics, and the open-loop, control system plant. Passive performance has been characterized, and the active performance measured in the laboratory will be verified when VISS is on-orbit.* (DTE: Shock and Vibration)

K

Kashkoush, I., In-Situ Chemical Concentration Control for Wafer Wet Cleaning, V. 41, No. 3, p. 24. *This paper demonstrates the use of conductivity sensors to monitor*

and control the concentration of RCA cleaning and hydrofluoric acid (HF) etching solutions. Commercially available electrodeless conductivity sensors were used to monitor and control the concentration of these process solutions. A linear relationship between the conductivity of the solution and the chemical concentration was obtained within the range studied. A chemical injection scheme was developed to maintain the chemical concentration within specified limits. Different concentrations of RCA and HF solutions were investigated. Results show that these techniques are suitable for monitoring and controlling the concentration of chemicals in the process tanks for better process control. These techniques provide low cost of ownership of the process by using dilute chemicals and longer bath life (i.e., a more environmentally sound process). (CC: Cleanroom Operation/Procedures, Identification, Measurement, and Monitoring)

Kaufman, D.S., Validation of Force-Limited Vibration Testing, V. 41, No. 3, p. 17. (Abstract—see D.B. Worth)

Kern, D.L., Development of Acoustic Test Criteria for the Cassini Spacecraft, V. 41, No. 1, p. 26, 1998. (Abstract—see Bergen, T.F.)

Kinney, P.D., Particle Transmission Through a Turbo Pump, V. 41, No. 3, p. 31. *Experiments were performed to determine if small particles are capable of passing through a turbo-molecular vacuum pump. A test aerosol was generated at atmospheric pressure and injected into the vacuum system upstream of the turbo pump. Particles were measured immediately upstream and downstream of the turbo pump using two laser-based vacuum particle detectors. Tests were performed with solid and liquid particles. Solid particles were found to pass through the pump, although the efficiency of transmission is not known. Liquid particles did not pass through the pump. These results indicate that vacuum particle counters employed downstream of turbo pumps may be sensitive to upstream particle levels.* (CC: Identification, Measurement, and Monitoring)

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Lee, J., Exposure of Inert Gas Purifiers to Air Studies on Hydrocarbon Release in Resin-Based vs. Nickel-Based Purifiers, V. 41, No. 6, p. 26. (Abstract—see Alvarez, D.)

Liu, B.Y.H. Particle Transmission Through a Turbo Pump, V. 41, No. 3, p. 31. (Abstract—see Kinney, P.D.)

M

Ma, C., Moisture Drydown in Ultra-High-Purity Oxygen Systems, V. 41, No. 1, p. 13, 1998. *Semiconductor manufacturing fabs use ultra-high-purity (UHP) oxygen for various process applications such as oxide growth, plasma etch, and chemical vapor deposition. Moisture is identified as one of the key impurities that can affect device production. Moisture drydown in inert gas delivery systems was studied. However, moisture drydown or outgassing characteristics in oxygen were found to be different from those of inert gas systems. Moisture adsorption and desorption in UHP oxygen systems were studied using advanced APIMS techniques for trace-level moisture analysis. To understand moisture reaction pathways, isotopic water was used as an adsorbate on 316L electropolished stainless steel (EPSS) surfaces. Experimental results from moisture drydown in the EPSS tubing were used to validate a theoretical model developed to predict the moisture drydown performance of large-scale, oxygen distribution systems. Both experimental and model results were shown to be useful in UHP oxygen system design, cost control, metrology, and contamination control.* (CC: Modeling and Simulation, Sources and Effects)

Malczewski, M.L., A Sampling System for Measurement of Nanometer-Sized Particles in Hydrogen, V. 41, No. 2, p. 23. *Particle counting in reactive gases such as hydrogen and oxygen using condensation nucleus counter (CNC) technology is now possible with counters such as the CPC 7651 which is commercially available. Described here is a sampling system that allows these counters to be used for continuous monitoring in hydrogen and oxygen. A closed sampling system is described which maintains the inlet of the particle counter at slightly above atmospheric pressure, using sample gas pressure to maintain the proper sample flow rate. This avoids the use of a sampling pump which is a potential ignition source when used with reactive gases. For continuous monitoring applications, refilling of the working fluid during operation is necessary.* (CC: Identification, Measurement, and Monitoring)

Mayne, A.W. III, Control of High-Intensity Acoustic Test Environments, V. 41, No. 3, p. 35. (Abstract—see Noreen, R.A.)

McDermott, W.T., A Gas Diluter for Measuring Nanometer-Sized Particles in Oxygen or Hydrogen, V. 41, No. 4, p. 17. *A laminar flow diluter tube was designed and tested. The tube dilutes reactive gas aerosols in nitrogen using molecular diffusion. No turbulent mixing of the gases occurs in the tube. The gases are diluted without substantially changing the particle concentration of the sample. The diluted gas can then be measured using an inert gas particle counter. A numerical model predicted the molecular diffusion and particle transport behavior of the tube. Experimental tests confirmed the predictions. The tube diluted sample hydrogen to a concentration of 6.5 percent and oxygen to a concentration of 17 percent. The same tube transported particles smaller than 10 nm with greater than 78 percent efficiency. Therefore, the diluter can be used with particle counters designed for nanometer-size sensitivity. The laminar flow diluter can be used to measure contaminant particle concentrations in filtered reactive gases.* (CC: Identification, Measurement, and Monitoring, Modeling and Simulation)

Moening, C.J., MIL-PRF-1540, A Performance Specification for Design and Product Verification of Space Hardware, V. 41, No. 2, p. 19. (Abstract—see Tanner, C.S.)

Monroe, S., Trace Moisture in Ammonia: Gas Chromatography Using Calcium Carbide, V. 41, No. 1, p. 21. *The conversion rate of water to acetylene is reported to depend on reaction temperature, cell size, flow rate, particle size, and the type of gas studied. Data will be presented quantifying the amount of C_2H_2 evolved from the reaction of CaC_2 with 3 to 10 ppm H_2O in both helium and ammonia*

gas under a defined set of experimental conditions. A calibration curve is presented to illustrate linearity for acetylene detection by gas chromatography/discharge ionization detection (GC/DID) under these experimental conditions down to 15 ppb ±1.5 ppb. (CC: Identification, Measurement, and Monitoring)

N

Nagarajan, R., Chemical Integration and Contamination Control in Hard Disk Drive Manufacturing, V. 41, No. 5, p. 31. (Abstract—see Nebenzahl, L.)

Nebenzahl, L., Chemical Integration and Contamination Control in Hard Disk Drive Manufacturing, V. 41, No. 5, p. 31. *As we approach the turn of the century, the demand for storage is rapidly increasingly, fueled by multimedia and its associated applications. Hard disk drive (HDD) manufacturers continue to respond by chasing the areal density curve to provide higher capacity and higher performance disk drives. In this paper, types and sources of contamination that can impact HDD performance are described; various contamination-related problems are reviewed; and a methodology by which successful chemical integration in the hard disk drive business can be accomplished is outlined.* (CC: Cleanroom Operation/ Procedures, Sources and Effects)

Noreen, R.A., Control of High-Intensity Acoustic Test Environments, V. 41, No. 3, p. 35. *During the past two years, three new acoustic test facilities representing a wide range of test capabilities were developed. These facilities differed significantly in the complexity of the noise generation systems, and thus the degree of spectral control that could be achieved. Control of the acoustic spectrum is accomplished by combining noise sources and components with limited capabilities into individual control bands in a manner that yields the desired overall performance. The paper shows the physical parameters involved that limit the performance capabilities of the components. Control requirements are developed for multiple bands through example calculations for an assumed acoustic facility model.* (DTE: Acoustics, Criteria and Standards)

Novak, R., In-Situ Chemical Concentration Control for Wafer Wet Cleaning, V. 41, No. 3, p. 24. (Abstract—see Kashkoush, I.)

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Paley, S.J., Comprehensive Particle and Fiber Testing for Cleanroom Wipers, V. 41, No. 6, P. 19. (Abstract—see Bhattacharjee, H.R.)

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Sullivan, J.M., Use of a Zero-Gravity Suspension System for Testing a Vibration Isolation System, V. 41, No. 6, p. 43. (Abstract—see Idle, M.K.)

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Tanner, C.S., MIL-PRF-1540, A Performance Specification for Design and Product Verification of Space Hardware, V. 41, No. 2, p. 19. *Acquisition reform has caused the cancellation or conversion of many military specifications and standards. One of the standards targeted for conversion by Air Force Material Command (AFMC) was MIL-STD-1540. The standard provides details for the testing of launch, upper stage, and space vehicles. AFMC requested that MIL-STD-1540C be converted from a standard to an alternative form of documentation. To answer this request, The Aerospace Corporation and Space and Missile Systems Center developed a document that retained the value of the original standard. The new document is MIL-PRF-1540 (a Military Performance Specification). MIL-PRF-1540 is intended for use in the Request For Proposal (RFP) instructions for new procurements of space hardware. The value of MIL-STD-1540C was retained by incorporating it into the already existing MIL-HDBK-340. The revised handbook, MIL-HDBK-340A, is referenced by MIL-PRF-1540 as guidelines only.* (DTE: Criteria and Standards, Solar and Space Simulation, Test Tailoring; PR: Acquisition Policies, Criteria and Standards)

Tosney, W.F., Orbital Experience from an Integration and Test Perspective, V. 41, No. 6, p. 35. *Space vehicle schedule and cost reduction strategies tend to focus on test optimization without a comprehensive analytical approach to the impact on mission success. This study provides valuable stochastic insight into orbital physics of failure while identifying potential relationships to ground integration and test processes by analyzing data across a large population of space vehicle programs. Failure data analysis uses reliability growth modeling techniques to provide greater insight into environmental test effectiveness. Results show correlations between orbital failures, environmental test, hardware retest, and hardware categories. Test strategies are discussed to mitigate risk of orbital failures for hardware subjected to varying degrees of retest and late integration.* (DTE: Solar and Space Simulation, Test Tailoring; PR: Acquisition Policies, Reliability Achievement)

Tram, A., Exposure of Inert Gas Purifiers to Air Studies on Hydrocarbon Release in Resin-Based vs. Nickel-Based Purifiers, V. 41, No. 6, p. 26. (Abstract—see Alvarez, D.)

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Verma, N., Moisture Drydown in Ultra-High-Purity Oxygen Systems, V. 41, No. 1, p. 13, 1998. (Abstract—see Ma, C.)

Volpe, L., Chemical Integration and Contamination Control in Hard Disk Drive Manufacturing, V. 41, No. 5, p. 31. (Abstract—see Nebenzahl, L.)

W

White, G.O., Temperature Response Characteristics of Various Vibration Isolators, V. 41, No. 5, p. 44. *Four types of vibration isolators were characterized to determine whether the system utilizing them could survive Arctic operation. Previous operation in a desert environment had been performed without difficulty. It was predicted that Arctic operations would be successful based on desert and laboratory information. Data at various temperatures were gathered in the lab, and power spectral density (PSD) data, transfer functions, and fatigue ratios were used to predict responses at Arctic temperatures. Predicted Arctic responses exceeded desert responses in some frequency regions, and it was determined that additional testing at Arctic temperatures was warranted.* (DTE: Climatics and Thermal, Shock and Vibration, Test Tailoring, Test Time Compression; PR: Durability/Fatigue)

Whitney, G., Chemical Integration and Contamination Control in Hard Disk Drive Manufacturing, V. 41, No. 5, p. 31. (Abstract—see Nebenzahl, L.)

Wilson, D.R., The New Triaxial Shock and Vibration System at Hill Air Force Base, V. 41, No. 2, p. 27. (Abstract—see Chen, M.)

Wong, J.S., Chemical Integration and Contamination Control in Hard Disk Drive Manufacturing, V. 41, No. 5, p. 31. (Abstract—see Nebenzahl, L.)

Worth, D.B., Validation of Force-Limited Vibration Testing, V. 41, No. 3, p. 17. *A sounding rocket experiment was performed on May 8, 1997, that contributed to the process of validating force-limited random vibration testing. A simple structure was flown and instrumented with accelerometers and force gages. The results of the data acquired during the flight tests are compared with predicted results which were performed prior to the flight tests. The data have helped to validate the force-limited testing approach for random vibration testing. Additionally, the data will be used for others to develop improved analytical techniques for force-limited vibration testing. This flight is the first in a series of at least three that will be performed.* (DTE: Shock and Vibration, Test Tailoring)

Y

Yang, J.H., Empirical Validation of a Gas Distribution System Moisture Drydown Model, V. 41, No. 2, p. 33. (Abstract—see Dheandhanoo, D.)

Yesenofski, D.F., Empirical Validation of a Gas Distribution System Moisture Drydown Model, V. 41, No. 2, p. 33. (Abstract—see Dheandhanoo, D.)

Z

Zhu, Sheng-Bai, Theoretical Study of Molecular Contamination on Silicon Wafers: Interactions Between Molecular Contaminants and the Silicon Surface, V. 41, No. 4, p. 30. *Molecular contamination on silicon wafers is mainly determined by the gas phase concentrations of the contaminants, the adsorption energy of the molecules on the surface, and their removal rate. In this paper, a potential energy function is developed to describe interactions between adsorbed molecules and solid surfaces. Ignoring possible chemical reactions at the interface, the development is based on a combination of the Pauli repulsion, the dispersion attraction, and the Coulomb interaction between real and image charges. This potential function will be used to predict adsorption energies of various organic/inorganic molecules, including oxygen, halogens, aliphatic hydrocarbons, acids, and inorganic carbon-containing compounds on silicon wafer surfaces.* (CC: Modeling and Simulation, Sources and Effects)

Zhu, Sheng-Bai, Theoretical Study of Molecular Contamination on Silicon Wafers: Kinetics, V. 41, No. 5, p. 36. *The relationship between the gas phase molecule concentration and the surface contamination density based on simple kinetic theories is established. The most important approximations in this derivation include the neglect of possible chemical reactions on the surface and the assumption that gas phase concentrations of pollutants are constants, both in time and in location. The diffusion mechanism is ignored. With these approximations, the equilibrium in surface kinetics can be reached almost instantly for all the molecules investigated, even for those having activation energies as high as ~ 72 kJ/mole. This agrees with the experimental data for moisture adsorption on stainless steel. A useful guide is provided for material selection.* (CC: Identification, Measurement, and Monitoring, Modeling and Simulation)

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